

## PATENT COOPERATION TREATY

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## INTERNATIONAL PRELIMINARY REPORT ON PATENTABILITY

(Chapter II of the Patent Cooperation Treaty)

(PCT Article 36 and Rule 70)

Applicant's or agent's file reference 030888PCT	<b>FOR FURTHER ACTION</b>		See Form PCT/PEA/416
International application No. PCT/JP2004/018684	International filing date (day/month/year) 08.12.2004	Priority date (day/month/year) 12.12.2003	
International Patent Classification (IPC) or national classification and IPC INV. F01L9/04			
Applicant TOYOTA JIDOSHA KABUSHIKI KAISHA et al.			
<p>1. This report is the international preliminary examination report, established by this International Preliminary Examining Authority under Article 35 and transmitted to the applicant according to Article 36.</p> <p>2. This REPORT consists of a total of 8 sheets, including this cover sheet.</p> <p>3. This report is also accompanied by ANNEXES, comprising:</p> <p>a. <input checked="" type="checkbox"/> sent to the applicant and to the International Bureau a total of 3 sheets, as follows:</p> <p><input type="checkbox"/> sheets of the description, claims and/or drawings which have been amended and are the basis of this report and/or sheets containing rectifications authorized by this Authority (see Rule 70.16 and Section 607 of the Administrative Instructions).</p> <p><input type="checkbox"/> sheets which supersede earlier sheets, but which this Authority considers contain an amendment that goes beyond the disclosure in the international application as filed, as indicated in item 4 of Box No. I and the Supplemental Box.</p> <p>b. <input type="checkbox"/> (sent to the International Bureau only) a total of (indicate type and number of electronic carrier(s)) , containing a sequence listing and/or tables related thereto, in electronic form only, as indicated in the Supplemental Box Relating to Sequence Listing (see Section 802 of the Administrative Instructions).</p>			
<p>4. This report contains indications relating to the following items:</p> <p><input checked="" type="checkbox"/> Box No. I Basis of the report</p> <p><input type="checkbox"/> Box No. II Priority</p> <p><input type="checkbox"/> Box No. III Non-establishment of opinion with regard to novelty, inventive step and industrial applicability</p> <p><input type="checkbox"/> Box No. IV Lack of unity of invention</p> <p><input checked="" type="checkbox"/> Box No. V Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement</p> <p><input type="checkbox"/> Box No. VI Certain documents cited</p> <p><input checked="" type="checkbox"/> Box No. VII Certain defects in the international application</p> <p><input checked="" type="checkbox"/> Box No. VIII Certain observations on the international application</p>			
Date of submission of the demand  05.10.2005		Date of completion of this report  23.03.2006	
Name and mailing address of the international preliminary examining authority:  European Patent Office - P.B. 5818 Patentlaan 2 NL-2280 HV Rijswijk - Pays Bas Tel. +31 70 340 - 2040 Tx: 31 651 epo nl Fax: +31 70 340 - 3016		Authorized officer  Paquay, J  Telephone No. +31 70 340-3944 	

**INTERNATIONAL PRELIMINARY REPORT  
ON PATENTABILITY**

International application No.  
PCT/JP2004/018684

**Box No. I Basis of the report**

1. With regard to the **language**, this report is based on the international application in the language in which it was filed, unless otherwise indicated under this item.
- ☐ This report is based on translations from the original language into the following language, which is the language of a translation furnished for the purposes of:
- ☐ international search (under Rules 12.3 and 23.1(b))
  - ☐ publication of the international application (under Rule 12.4)
  - ☐ international preliminary examination (under Rules 55.2 and/or 55.3)
2. With regard to the **elements\*** of the international application, this report is based on *(replacement sheets which have been furnished to the receiving Office in response to an invitation under Article 14 are referred to in this report as "originally filed" and are not annexed to this report)*:

**Description, Pages**

1-31 as originally filed

**Claims, Numbers**

1-3 as originally filed

**Claims, Pages**

4-10 filed with telefax on 05.10.2005

**Drawings, Sheets**

1/14-14/14 as originally filed

- ☐ a sequence listing and/or any related table(s) - see Supplemental Box Relating to Sequence Listing
3. ☐ The amendments have resulted in the cancellation of:
- ☐ the description, pages
  - ☐ the claims, Nos.
  - ☐ the drawings, sheets/figs
  - ☐ the sequence listing (*specify*):
  - ☐ any table(s) related to sequence listing (*specify*):
4. ☒ This report has been established as if (some of) the amendments annexed to this report and listed below had not been made, since they have been considered to go beyond the disclosure as filed, as indicated in the Supplemental Box (Rule 70.2(c)).
- ☐ the description, pages
  - ☒ the claims, Nos. 9,10
  - ☐ the drawings, sheets/figs
  - ☐ the sequence listing (*specify*):
  - ☐ any table(s) related to sequence listing (*specify*):

\* If item 4 applies, some or all of these sheets may be marked "superseded."

**INTERNATIONAL PRELIMINARY REPORT  
ON PATENTABILITY**

International application No.  
PCT/JP2004/018684

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**Box No. V Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement**

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1. Statement

Novelty (N)	Yes: Claims	1-3,7,8
	No: Claims	4-6
Inventive step (IS)	Yes: Claims	1-3,7,8
	No: Claims	4-6
Industrial applicability (IA)	Yes: Claims	1-8
	No: Claims	

2. Citations and explanations (Rule 70.7):

**see separate sheet**

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**Box No. VII Certain defects in the international application**

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The following defects in the form or contents of the international application have been noted:

**see separate sheet**

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**Box No. VIII Certain observations on the international application**

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The following observations on the clarity of the claims, description, and drawings or on the question whether the claims are fully supported by the description, are made:

**see separate sheet**

**Re Item I**

**Basis of the report**

- 1 This opinion has been established as if (some of) the amendments had not been made, since they have been considered to go beyond the disclosure as filed (Rule 70.2 (c)).
- 2 The added claims 9 and 10 mention each "*...a target of a time area...*". As the original application mentions the "*target*" only in combination with the working angle (on description page 5, line 6) and not in combination with the time area, the addition of this feature in the claims 9 and 10 introduces subject-matter which extends beyond the content of the application as filed, contrary to Article 19(2)/Article 34(2)(b) PCT.

**Re Item V**

**Reasoned statement with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement**

Reference is made to the following documents:

- D1: US-A-5 494 007 (SCHROEDER ET AL) 27 February 1996 (1996-02-27)
- D2: US 2003/213452 A1 (POMERLEAU DAN) 20 November 2003 (2003-11-20)
- D3: DE 101 51 201 A1 (MASBERG, ULLRICH) 30 April 2003 (2003-04-30)

- 1 The claims 1 to 3 meet the criteria of Article 33(1) PCT, because the subject-matter of claims 1 to 3 is new and involves an inventive step in the sense of Article 33(3) PCT.
  - 1.1 To claim 1: The document D1 is regarded as being the closest prior art to the subject-matter of claim 1 and discloses (the references in parentheses applying to this document) a valve gear (figures 1, 5 and 6) of an internal combustion engine converting a rotational motion (column 1, lines 53-55) of an electric motor (10) into a linear motion by a cam (24', 24''), and driving a valve (18) of a cylinder so as to be opened and closed based on the linear motion, the valve gear comprising an electric

motor control means (100) capable of actuating the electric motor in a rocking drive mode (column 6, line 45-48) in which a rotating direction of the cam is changed during a lift of the valve.

Document D1 does not mention that the rocking control means for controlling a motion of the electric motor starts rotating before the valve starts lifting in the rocking drive mode.

Nevertheless, document D1 mentions this feature for the continuous rotary motion mode (column 2, line 48-50). A man skilled in the art who has to construct the device of document D1 will prefer to construct the electric motor with continuous rotary motion (column 2) because he knows that in general a continuous rotary motion requires less energy than a rocking drive mode, in which a rotating direction of the cam is changed during a lift of the valve. Therefore, he will not combine features and elements of the continuous rotary motion electric motor with the rocking drive mode motor (column 6, line 45-48). Thus, the man skilled in the art will not come to the subject-matter of claim 1 without being inventive. In view of that, the subject-matter of claim 1 is inventive according to Article 33(3)PCT.

1.2 Claims 2 and 3 are dependent on claim 1 and as such also meet the requirements of the PCT with respect to novelty and inventive step.

2 The present application does not meet the criteria of Article 33(1) PCT, because the subject-matter of claims 4-6 is not new in the sense of Article 33(2) PCT.

2.1 To claim 4: The document D1 is regarded as being the closest prior art to the subject-matter of claim 4 and discloses (*the references in parentheses applying to this document*) a valve gear (*figures 1, 5 and 6*) of an internal combustion engine converting a rotational motion (*column 1, lines 53-55*) of an electric motor (10) into a linear motion by a cam (24', 24''), and driving a valve (18) of a cylinder so as to be opened and closed based on the linear motion, the valve gear comprising an electric motor control means (100) capable of actuating the electric motor in a forward

rotating drive mode (*column 2, line 31*) in which the cam is continuously rotated in one direction and wherein the electric motor control means (100) comprises forward rotating control means for changing a rotating speed of the cam before the valve starts lifting (*column 2, line 49: "acceleration and deceleration take place primarily while the valve is closed"= before the valve starts lifting*) in the forward rotating drive mode so as to change a working angle of the valve (*column 8, line 9-12*).

In view of the fact that all the features of the first claim are known from document D1, the subject-matter of this first claim is not new in the sense of Article 33(2) PCT.

- 2.2 To claim 5: From document D1 it is clear, that the cam needs one rotation for an entire valve opening / closing cycle. This entire cam rotation takes places during only a part of an entire crankshaft (engine output shaft) rotation. This means, that the average cam rotational speed is higher than the average engine output shaft rotation speed.

As this corresponds exactly to the in claim 5 claimed subject-matter, the subject-matter of claim 5 cannot be considered as being new in the sense of Article 33(2) PCT.

- 2.3 To claim 6: The document D3 is regarded as being the closest prior art to the subject-matter of claim 6 and discloses (*the references in parentheses applying to this document*) a valve gear (*figure 1a and 1b*) of an internal combustion engine converting a rotational motion of an electric motor (8) into a linear motion by a cam (10), and driving a valve (1) of a cylinder so as to be opened and closed based on the linear motion, comprising: electric motor control means (27) capable of actuating the electric motor (8) in each of a forward rotating drive mode in which the cam is continuously rotated in one direction (*column 8, line 55-58*), and a rocking drive mode (*column 8, line 55-58*) in which a rotating direction of the cam is changed during a lift of the valve, wherein the electric motor control means (27) comprises changing control means for controlling a motion of the electric motor in at least any one of the rocking drive mode and the forward rotating drive mode such that a time area obtained by integrating a lift amount of the valve approximately coincides between before and after changing the mode, at the time of changing the rocking drive mode

and the forward rotating drive mode (*In column 8, lines 52-58, it is explained that especially for longer opening times, the rotating direction is switched during a valve stroke at the moment where the valve lift is maximal. Figure 3 shows, compared to figure 4, such a longer opening time. In this figure, the time area before and after the maximum valve lift coincide*).

Because of the fact, that document D2 contains all the features of claim 6, the subject-matter of claim 6 is not new in the sense of Article 33(2) PCT

**Re Item VII**

**Certain defects in the international application**

- 1 Independent claims 1, 4 and 6 are not in the two-part form in accordance with Rule 6.3(b) PCT, which in the present case would be appropriate, with those features known in combination from the prior art being placed in the preamble (Rule 6.3(b)(I) PCT) and with the remaining features being included in the characterising part (Rule 6.3(b)(ii) PCT).
- 2 Contrary to the requirements of Rule 5.1(a)(ii) PCT, the relevant background art disclosed in the documents D1 to D3 is not mentioned in the description, nor are these documents identified therein.
- 3 The features of the claims are not provided with reference signs placed in parentheses (Rule 6.2(b) PCT).

**Re Item VIII**

**Certain observations on the international application**

- 1 To the claims 1, 4 and 6: Although claims 1, 4 and 6 have been drafted as separate

independent claims, they appear to relate effectively to the same subject-matter and to differ from each other only with regard to the definition of the subject-matter for which protection is sought and in respect of the terminology used for the features of that subject-matter. The aforementioned claims therefore lack conciseness and as such do not meet the requirements of Article 6 PCT.

- 2 To claim 7: This claim contains the words "*changing time*". These words are not explained in the application, they are only mentioned in the description on page 6, line 11. As these words are very general, even a man skilled in the art might link these words to different things. "*Changing time*" could mean that the timing of valve opening and closing is changed, but it also could mean, that the time of changing the rotating direction is changed.  
These several different explanations make the claim vague and unclear and leave the reader in doubt as to the desired protection, thereby rendering the subject-matter of claim 7 unclear, Article 6 PCT.



the valve.

4. A valve gear of an internal combustion engine converting a rotational motion of an electric motor into a linear motion by a cam, and driving a valve of a cylinder so as to be opened and closed based on the linear motion, the valve gear comprising:

electric motor control means capable of actuating the electric motor in a forward rotating drive mode in which the cam is continuously rotated in one direction,

wherein the electric motor control means comprises forward rotating control means for changing a rotating speed of the cam before the valve starts lifting in the forward rotating drive mode so as to change a working angle of the valve.

5. The valve gear according to claim 4, wherein the forward rotating control means changes the rotating speed of the cam to a predetermined speed which is different from a basic speed obtained by dividing a rotating speed of an engine output shaft of the internal combustion engine by a rotation number of the engine output shaft from a start of an intake stroke to an end of an exhaust stroke, before starting the lift of the valve, and rotates the cam at the predetermined speed during the lift of the valve.

6. A valve gear of an internal combustion engine converting a rotational motion of an electric motor into a linear motion by a cam, and driving a valve of a cylinder so as to be opened

and closed based on the linear motion, comprising:

electric motor control means capable of actuating the electric motor in each of a forward rotating drive mode in which the cam is continuously rotated in one direction, and a rocking drive mode in which a rotating direction of the cam is changed during a lift of the valve,

wherein the electric motor control means comprises changing control means for controlling a motion of the electric motor in at least any one of the rocking drive mode and the forward rotating drive mode such that a time area obtained by integrating a lift amount of the valve approximately coincides between before and after changing the mode, at the time of changing the rocking drive mode and the forward rotating drive mode.

7. The valve gear according to claim 6, wherein the changing control means control the motion of the electric motor in the rocking drive mode such that a maximum lift amount of the valve in the rocking drive mode is increased according to being closer to the changing time of the mode.

8. The valve gear according to claim 7, wherein the changing control means controls an opening degree of a throttle valve of the internal combustion engine such that the opening degree of the throttle valve is reduced according to an increase of the maximum lift amount.

9. (new) The valve gear according to claim 1, wherein the rocking

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control means controls the rotating speed of the cam in the rocking drive mode such that a target of a working angle of the valve is realized and a target of a time area obtained by integrating a lift amount of the valve is realized.

10. (new) The valve gear according to claim 4, wherein the forward rotating control means changes the rotating speed of the cam in the forward rotating drive mode such that a target of a working angle of the valve is realized and a target of a time area obtained by integrating a lift amount of the valve is realized.